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ABSTRACT

Changes in women's attainment of higher education during the 1970s have been dramatic. This paper documents trends toward women acquiring a higher proportion of degrees at all levels and moving into traditionally male fields of study. In 1980, females were awarded nearly half of all baccalaureate and master's degrees, slightly less than one-third of all doctoral degrees, and one-fourth of all first professional degrees. Moreover, on the undergraduate level, there were substantial increases in women's representation in traditionally male fields of study like business and management, agriculture, engineering, and computer science. Using regression analysis, the decline in an index of sex segregation by field of study among baccalaureate degree recipients is shown to be associated with a decline in an index of sex segregation among professional occupations. These trends in higher education suggest that young women will exhibit a greater attachment to the labor force than their older counterparts. (Author/CMG)

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HIGHER EDUCATION FIELDS OF STUDY AND PROFESSIONAL EMPLOYMENT: TRENDS IN SEX SEGREGATION DURING THE 1970s

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Abstract

Changes in women's attainment of higher education during the 1970s have been dramatic. This paper documents trends toward women acquiring a higher proportion of degrees at all degree levels and moving into traditionally male fields of study. Using regression analysis, the decline in an index of sex segregation by field of study among bachelor's degree recipients is shown to be associated with a decline in an index of sex segregation among professional occupations. These movements in higher education among young women suggest that they will exhibit a greater attachment to the labor force than their older counterparts.

Introduction

Changes in women's attainment of higher education in recent years have been dramatic. Women are more likely to go on for advanced degrees at all degree levels. At the bachelor's level, their representation in such traditionally male fields of study as agriculture, business, computer science, architecture, and law has increased rapidly.

These changes in higher education have direct implications for women's labor force participation rates, degree of attachment to the labor force, and occupational choice. In 1979, the labor force participation rate for all women with eight or fewer years of education was 23.2 percent, for those who completed high school, 57.1, for college graduates, 67.1 (U.S. Department of Labor, 1980, Table 44), and for women with doctorates, over 90 percent (Ferber and Kordick, 1978). Between 1970 and 1979, the increase in the labor force participation rates of women, aged 25 to 54, was greater the higher the educational level: the participation rates for women with less than high school increased by 6.8 percent, for women who completed high school by 21.5, and for women with four or more years of college by 24.4 (U.S. Department of Labor, 1981). Thus, as women's educational attainment increases, they not only move into groups with higher labor force participation rates, but also with faster growing rates. In addition, significant changes in the fields that women study moved them toward more market-oriented human capital during the seventies. Women moved into fields associated with occupations that typically require a greater attachment to the labor force--for example,

engineering, agriculture and business--that is, fields in which skills decay rapidly during periods out of the labor force. Recent data confirm this increased labor force attachment. According to estimates by the Bureau of Labor Statistics (February 1983), the average number of years a woman of 16 could anticipate spending in the labor force had increased by 5 years from 22.5 in 1970 to 27.7 in 1977, at which date their expectancy figure was 71 percent that of men.

These dramatic changes in women's attainment of higher education and concomitant increases in their labor force participation and attachment have important implications for home and family life. First, more highly educated women have fewer children. Increased education increases the value of women's time, encouraging substitution away from time-intensive activities such as childrearing, and increasing entry into the labor market (Schultz, 1973). Anticipation of being in the labor force a higher fraction of one's lifetime increases education and changes field of study as well (Polachek, 1978). Young women who plan to participate in the labor force reduce their expected family by almost one child (Waite and Stolzenberg, 1976). The increasing investment of women in market-oriented human capital will lead them to choose more nontraditional occupations that place greater demands on commitment of time. Thus, second, less time will be available for home production. This should lead to a number of changes in the consumer market, e.g., to an increase in demand for time-saving devices and strategies for use in the home, such as the microwave oven, convenience foods and time management techniques. It should also continue to reduce fertility because children are among the most time-intensive of all home production. Other consequences may be the increasing prevalence of delayed childbearing and a growing demand for alternative sources of child care.

The primary purpose of this paper is to examine recent trends in women's attainment of higher education in the U.S. It analyzes the trends in numbers and percentages of degrees awarded to women in various fields of study from 1970-71 to 1979-80. Since this is being presented to a conference of home economists, we pay special attention to showing the extent to which degrees granted in various sub-fields of home economics increased somewhat over this period despite the decline in other traditionally female fields of study. It then shows that the change in women's college majors toward traditionally male fields of study has been associated with an increased entry into the traditionally male professional occupations. The education data used in this study are from the National Center for Education Statistics (NCES), which collects data on degrees awarded annually from all accredited degree-granting institutions of higher education in the U.S. The data for 3-digit Census occupations are from the Bureau of Labor Statistics' (BLS) annual averages of the monthly Current Population Survey (CPS), published in Employment and Earnings.

In the next section, we document these trends in educational attainment by sex for all degree levels (bachelor's, master's, doctorate and first-professional degrees). In Section III, we show

the extent to which women's fields of study have become more similar to men's during the seventies. Degrees granted in various fields of home economics also are discussed. In Section IV, we discuss trends in segregation among college majors by introducing a summary measure of the degree of segregation which we relate to the trend in segregation in professional occupations. In the final section, we discuss the trends and implications for labor force attachment of younger women.

Trends in Educational Attainment

Women obtained an increasing proportion of degrees at all degree levels over the seventies. As shown in Table 1, while the number of women receiving bachelor's degrees increased between 1971 and 1980, the number of men remained relatively constant. Consequently, women increased their share of all bachelor's degrees awarded from 43.5 percent in 1971 to 49.2 percent in 1980 (cols. 3-4). By 1980, the number of women completing bachelor's degrees equaled the number of men. Ironically, data elsewhere suggest that the payoff for a college degree is now falling (Welch, 1979).

The total number of master's degrees awarded increased by 29 percent between 1971 and 1980. The proportional growth in master's degrees awarded to women was much greater than for men: the number of women receiving master's degrees increased by 59.2 percent, and the number of men by 9.1 percent during the seventies. By 1980, approximately the same number of men and of women received master's degrees. Whereas women received a lower proportion of master's than of bachelor's degrees in 1971, they received a slightly higher proportion of the former in 1980.

The number of doctorates awarded to women increased by 5,000 between 1971 and 1980, a figure which is identical to the amount by which the number awarded to men decreased. This represents a rate of growth of 111.4 percent for women. Accordingly, the ratio of women to men among doctoral degree recipients increased from .17 in 1971 to .42 in 1980. Although the number of women awarded doctorates doubled between 1971 and 1980, their representation among doctoral degree holders was still significantly lower than at the bachelor's or master's levels.

The most dramatic gains for women came in their number and proportion of first-professional degrees, such as law, medicine, and dentistry. While the level is low, the change has been very large. Their number of such degrees grew by over 600 percent between 1971 and 1980, expanding their share from 6.5 to 24.9 percent of first-professional degrees awarded. By 1980, they still received only one-fourth of all first-professional degrees though, the lowest for any degree.

Not only did women increase their share of degrees awarded during the seventies, but they also moved into traditionally male fields of study in increasing numbers. In the next section, we will document

Table 1. Bachelor's, Master's, Doctoral, and First-professional Degrees Conferred in Institutions of Higher Education in the U.S., by Sex: 1970-71 and 1979-80

	All Degrees		Bachelor's		Master's		Doctoral		First-Professional	
	1970-71	1979-80	1970-71	1979-80	1970-71	1979-80	1970-71	1979-80	1970-71	1979-80
Total	1,147,985	1,342,504	846,110	940,251	231,486	299,095	32,113	32,632	38,276	70,526
Men	680,344	704,847	478,423	477,750	138,590	151,159	27,534	22,950	35,797	52,988
Women	467,641	637,657	367,687	462,501	92,896	147,936	4,579	9,682	2,479	17,538
					Percentage Distribution					
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Men	59.3	52.5	56.5	50.8	59.9	50.5	85.7	70.3	93.5	75.1
Women	40.7	47.5	43.5	49.2	40.1	49.5	14.3	29.7	6.5	24.9
					Percent Change, 1970-71 to 1979-80					
Total	16.9		11.1		29.2		1.6		84.3	
Men	3.6		- 0.1		9.1		-16.6		48.0	
Women	36.4		25.8		59.2		111.4		607.5	

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 13-18 and Earned Degrees Conferred 1979-80, pp. 20-25.

these changes for each of the degree levels.

Trends in Field of Study by Sex

Bachelor's Degrees

During the seventies, significant shifts in college majors occurred. According to Table 2, women increased their number and share of degrees in all traditionally male fields, except theology. Some traditionally female fields experienced decreasing trends in the number and proportion of women, namely education and letters. But two traditionally female fields continued to expand, while the proportion of women declined: nursing and home economics.

Figure 1 shows that the traditionally male fields of study--agriculture, law, business and management, architecture and physical sciences--received a growing share of the new female students. The data in Table 2 show that the largest gains between 1971 and 1980 in the number of bachelor's degrees awarded to women occurred in business and management (53,000) with women's share increasing from one out of ten in 1971 to one out three in 1980. Women increased their share of degrees in every sub-field of business and management over this period, except secretarial studies, with the largest gains in accounting (13,500) and business management and administration (17,000). Detailed data on bachelor's degrees by sub-field may be found in the Appendix, Table A-1. The number of women majoring in agriculture and natural resources among bachelor's degree recipients grew by 6200 over the decade. Females increased their proportion of degrees in this field from 4.2 percent in 1971 to 29.6 in 1980. The proportion of women degree recipients in architecture and environmental design and in computer and information sciences more than doubled. While men were clearly predominant in engineering, there was a noticeable increase in the percent of women in the field from 0.8 in 1971 to 9.3 percent in 1980. Other dramatic gains occurred in the proportion of females in the fields of computer and information sciences and law. All of these fields expanded over the period.

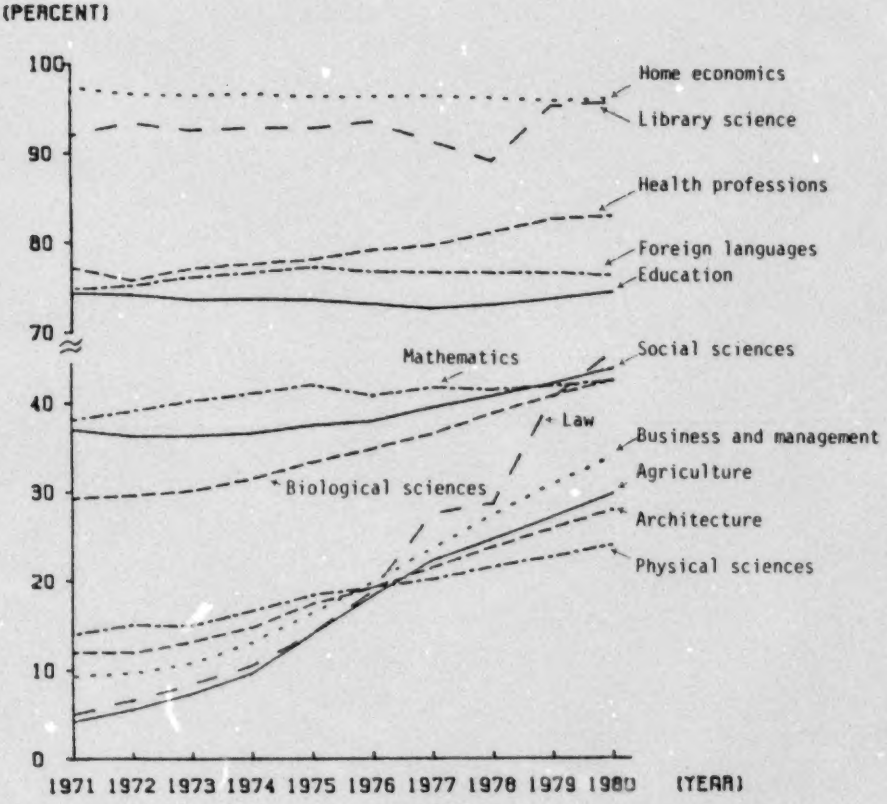
In contrast to the dramatic increase in the number of women in the growing traditionally male fields, several traditionally female fields experienced a decline both in size and in the proportion female. The number of bachelor's degrees awarded decreased in six discipline divisions between 1971 and 1980: in four traditionally female disciplines--education (-56,958), letters (-32,473), foreign languages (-9,108), and library science (-615), and in two somewhat male disciplines--social sciences (-51,820) and mathematics (-13,445). The proportion of degrees awarded to women decreased slightly in education and letters and increased somewhat in the other fields. The largest decline in the number of women occurred in elementary education; although the majority of elementary and pre-elementary education graduates continue to be women, men increased their proportion in these traditionally female fields slightly. In the social sciences division, history, sociology and general social

Table 2. Bachelor's Degrees Conferred by Sex and Major Field of Study in the U.S.: 1970-71 and 1979-80

Major Field of Study	1970-71			1979-80			Percent Change in Number Awarded to Women 1970-71 to 1979-80
	Number Awarded		Percent Awarded to Women	Number Awarded		Percent Awarded to Women	
	Total	Women		Total	Women		
ALL FIELDS	846,110	367,687	43.4	940,251	462,501	49.2	25.8
Agriculture and natural resources	12,710	539	4.2	22,903	6,787	29.6	1,159.2
Architecture and environmental design	5,578	667	12.0	9,176	2,548	27.8	282.0
Area studies	2,497	1,322	52.9	2,489	1,506	60.5	13.9
Biological sciences	36,033	10,571	29.3	47,111	19,976	42.4	89.0
Business and management	116,709	10,803	9.3	189,224	63,883	33.8	491.3
Communications	10,802	3,813	35.3	28,649	14,983	52.3	292.9
Computer and information sciences	2,388	324	13.6	11,213	3,399	30.3	949.1
Education	177,638	132,236	74.4	120,680	89,214	73.9	-32.5
Engineering	50,357	403	.8	69,265	6,438	9.3	1,497.5
Fine and applied arts	30,447	18,169	59.7	40,953	25,865	63.2	42.4
Foreign languages	20,433	15,285	74.8	11,325	8,568	75.7	-43.9
Health professions	25,484	19,680	77.2	64,597	53,151	82.3	170.1
Home economics	11,271	10,970	97.3	18,533	17,722	95.4	61.5
Law	545	27	5.0	683	311	45.5	1,051.9
Letters	73,398	44,782	61.0	40,925	24,328	59.4	-45.7
Library science	1,013	932	92.0	398	378	95.0	-59.4
Mathematics	24,918	9,494	38.1	11,473	4,848	42.3	-48.9
Physical sciences	21,549	3,014	14.0	23,661	5,651	23.9	87.5
Psychology	38,154	17,037	44.7	42,513	26,923	63.3	58.0
Public affairs and services	9,303	4,566	49.1	38,155	21,093	55.3	362.0
Social sciences	156,698	57,918	37.0	104,878	45,805	43.7	-20.9
Theology	3,744	1,017	27.2	6,238	1,583	25.4	55.7
Interdisciplinary studies	14,084	4,117	29.2	34,908	17,531	50.2	325.8

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 13-17 and Earned Degrees Conferred 1979-80, pp. 20-24.

Figure 1. Percent Female Among Bachelor's Degree Recipients by Major Field of Study, 1970-71 to 1979-80



Source: National Center for Education Statistics, *EARNED DEGREES CONFERRED: 1970-71*, p. 12; *1978-79*, p. 21; and *1979-80*, p. 26.

sciences recorded substantial decreases in the number of female degree recipients, but the female proportion in these fields increased. The dramatic declines in the number of majors in education, social sciences and letters are probably due to conditions in the job market, a topic beyond the scope of this paper.

It is interesting to note that although the proportion of degrees awarded to women declined in the two most female-dominated fields, nursing and home economics, the total number of degrees awarded in these fields increased. The proportion male in nursing increased from 2.1 percent in 1971 to 5.5 percent in 1980. Within the home economics division, the proportion male increased from 2.7 in 1971 to 5.6 in 1980; all sub-fields except the "other" category experienced a slight increase in the proportion male. The number of degrees awarded to men increased from 254 to 1,798 in nursing and from 301 to 861 in home economics. This trend suggests that some males also are making an attempt to break away from conventional educational molds.

Master's Degrees

As shown in Table 3, at the master's level, traditionally male-dominated fields like business and management, agriculture, architecture, computer science, and law gained increasing proportions of women over the decade. The most female-dominated fields of library science and home economics showed a steady or slightly declining proportion of women, respectively. Except for library science, the number of master's degrees awarded grew in each of these fields. Thus, at the master's level, women do not appear to be leaving the female-dominated fields to enter the male fields; rather, they are simply more likely to go on for master's degrees and this added growth is largely in the traditionally male fields of study.

The total number of master's degrees awarded increased by 59 percent over the decade, and women increased their proportion of degrees in all discipline divisions but home economics and library science. The largest increases occurred in education (22,742), business and management (11,310), health professions (8,153), and public affairs and services (6,485). The growth in the number of master's degrees awarded in education is due entirely to the increased number of female degree recipients for the number of degrees awarded to men in education declined by 8,000 between 1971 and 1980. More than half, 53.8 percent, of all master's degrees awarded to women in 1971 were in education; by 1980, this had decreased, but only slightly, to 49.2 percent. Despite the overall increase, the number of master's degrees awarded decreased in eight fields: social sciences (-4,301), letters (-4,177), foreign languages (-2,527), mathematics (-2,333), library science (-1,625), physical sciences (-1,153), area studies (-245) and engineering (-207). Among these contracting fields, the number of degrees awarded to women, nevertheless, increased in engineering (957) and physical sciences (122), increasing women's proportion of master's degrees awarded in these fields.

Table 3. Master's Degrees Conferred by Sex and Major Field of Study in the U.S.: 1970-71 and 1979-80

Major Field of Study	1970-71			1979-80			Percent Change in Number Awarded to Women 1970-71 to 1979-80
	Number Awarded		Percent Awarded to Women	Number Awarded		Percent Awarded to Women	
	Total	Women		Total	Women		
ALL FIELDS	231,486	92,896	40.1	299,095	147,936	49.5	59.2
Agriculture and natural resources	2,458	144	5.9	3,987	894	22.4	520.8
Architecture and environmental design	1,724	243	14.1	3,157	900	28.5	270.4
Area studies	1,017	397	39.0	772	369	47.8	- 7.1
Biological sciences	5,756	1,943	33.8	6,536	2,425	37.1	24.8
Business and management	26,654	1,045	3.9	55,322	12,355	22.3	1,082.3
Communications	1,856	642	34.6	3,084	1,556	50.5	142.4
Computer and information sciences	1,588	164	10.3	3,647	764	20.9	365.9
Education	89,067	50,020	56.2	103,720	72,762	70.2	45.5
Engineering	16,457	185	1.1	16,250	1,142	7.0	517.3
Fine and applied arts	6,678	3,165	47.4	8,709	4,642	53.3	46.7
Foreign languages	4,779	3,126	65.4	2,252	1,585	70.4	-49.3
Health professions	5,902	3,272	55.4	15,812	11,425	72.3	249.2
Home economics	1,453	1,365	93.9	2,690	2,456	91.3	79.9
Law	955	46	4.8	1,817	286	15.7	521.7
Letters	12,743	7,328	57.5	8,566	5,192	60.6	-29.1
Library science	7,028	5,713	81.3	5,403	4,391	81.3	-23.1
Mathematics	5,201	1,524	29.3	2,868	1,036	36.1	-32.0
Physical sciences	6,386	853	13.4	5,233	975	18.6	14.3
Psychology	4,438	1,651	37.2	7,861	4,464	56.8	170.4
Public affairs and services	8,406	4,099	48.8	20,268	10,584	52.2	158.2
Social sciences	16,522	4,710	28.5	12,221	4,425	36.2	- 6.1
Theology	2,710	661	24.4	3,922	1,217	31.0	84.1
Interdisciplinary studies	1,706	600	35.2	4,952	2,091	42.2	248.5

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 13-17 and Earned Degrees Conferred 1979-80, pp. 20-24.

Doctoral Degrees

Table 4 shows that the number of women receiving doctoral degrees more than doubled between 1971 and 1980, and that their numbers and proportion increased in all fields. By 1980, women received 30 percent of all doctorates awarded, whereas in 1971, they received only 14 percent. Even so, while women now receive around one-half of all bachelor's and master's degrees, they still receive less than one-third of all doctorates. Moreover, their representation in traditionally male fields of study is lower at the doctoral level than at the other two degree levels. Nevertheless, the percentage change in their numbers in the traditionally male fields is greater than in other fields, showing a similar trend toward male-dominated fields as at the lower degree levels.

The total number of doctoral degrees awarded decreased in ten fields between 1971 and 1980: physical sciences (-1,296), engineering (-1,131), letters (-539), mathematics (-475), social sciences (-434), foreign languages (-232), agriculture and natural resources (-95), business and management (-14), biological sciences (-7), and area studies (-4). The decline is entirely attributable to the decreased number of men in these fields. Women are more likely to go on for doctoral degrees, while men are much less likely than a decade ago; thus, women's representation among doctoral degree recipients increased significantly during the seventies.

In 1971, the only discipline division with a high (over 40 percent) representation of women among doctoral degree recipients was home economics with 61 percent. Nine years later, six more discipline divisions recorded a high female proportion: foreign languages (57%), library science (52%), health professions (45%), education (44%), psychology (42%), and letters (41%). The number of divisions with low (less than ten percent) proportions of women decreased from nine (architecture, mathematics, physics, agriculture, business, computer sciences, theology, engineering, and law) in 1971 to three (law, theology, and engineering) in 1980. As the outlook for employment of Ph.D.'s deteriorated over the seventies, men got fewer Ph.D.'s but women got more. Men moved instead into professional schools which experienced tremendous growth over the decade of the seventies.

First-Professional Degrees

As mentioned earlier, the number of first-professional degrees awarded increased by 84 percent during the seventies. As can be seen in Table 5, women captured a significant share of this expansion. The growth in the number of women among first-professional degree recipients is dramatic and pervades all of the specialties. The growth ranges from over 300 percent in medicine to over one thousand percent in dentistry, optometry, osteopathy and podiatry. In 1971, only one out of a hundred first-professional degrees in dentistry went to a woman, while nine years later one out of ten did. The number of women first-professional degree recipients in medicine increased about four times during the period. The largest numerical gains occurred in

Table 4. Doctoral Degrees Conferred by Sex and Major Field of Study in the U.S.: 1970-71 and 1979-80

Major Field of Study	1970-71 Number Awarded Total	1970-71 Number Awarded Women	1970-71 Percent Awarded to Women	1979-80 Number Awarded Total	1979-80 Number Awarded Women	1979-80 Percent Awarded to Women	Percent Change in Number Awarded to Women 1970-71 to 1979-80
ALL FIELDS	32,113	4,579	14.3	32,632	9,682	29.7	111.4
Agriculture and natural resources	1,086	31	2.9	991	112	11.3	261.3
Architecture and environmental design	36	3	8.3	79	13	16.5	333.3
Area studies	149	26	17.4	145	50	34.5	92.3
Biological sciences	3,645	595	16.3	3,638	947	26.0	59.2
Business and management	810	23	2.8	796	115	14.4	400.0
Communications	145	19	13.1	193	72	37.3	278.9
Computer and information sciences	120	3	2.3	240	27	11.3	800.0
Education	6,398	1,355	21.2	7,940	3,521	44.3	159.9
Engineering	3,638	23	.6	2,507	95	3.8	313.0
Fine and applied arts	621	138	22.2	655	242	36.9	75.4
Foreign languages	781	297	38.0	549	315	57.4	6.1
Health professions	466	77	16.5	786	351	44.7	355.8
Home economics	123	75	61.0	192	146	76.0	94.7
Law	20	--	--	40	4	10.0	--
Letters	2,416	567	23.5	1,877	770	41.0	35.8
Library science	39	11	28.2	73	38	52.1	245.5
Mathematics	1,199	93	7.8	724	100	13.8	7.5
Physical sciences	4,391	246	5.6	3,095	386	12.5	56.9
Psychology	1,782	427	24.0	2,775	1,171	42.2	174.2
Public affairs and services	178	43	24.2	392	138	35.2	220.9
Social sciences	3,659	507	13.9	3,225	874	27.1	72.4
Theology	312	6	1.9	1,319	77	5.8	1,183.3
Interdisciplinary studies	91	14	15.4	401	118	29.4	742.9

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 13-17 and Earned Degrees Conferred 1979-80, pp. 70-74.

Table 5. First-professional Degrees Conferred by Institutions of Higher Education, by Sex of Student and Field of Study in the U.S.: 1970-71 and 1979-80*

	1970-71			1979-80			Percent Change in Number Awarded to Women 1970-71 to 1979-80
	Total	Men	Women	Total	Men	Women	
NUMBER							
Total, all institutions	38,276	35,797	2,479	70,526	52,988	17,538	607.5
Dentistry (D.D.S. or D.M.D.)	3,777	3,731	46	5,321	4,602	719	1,463.0
Medicine (M.D.)	8,986	8,157	829	15,046	11,523	3,523	325.0
Optometry (O.D.)	531	518	13	1,085	915	170	1,207.7
Osteopathic medicine (D.O.)	472	461	11	1,011	852	159	1,345.5
Podiatry (Pod.D. or D.P.) or Podiatric medicine (D.P.M.)	240	235	5	580	507	73	1,360.0
Veterinary medicine (D.V.M.)	1,252	1,154	98	1,835	1,233	602	514.3
Law (L.L.B. or J.D.)	17,652	16,359	1,293	35,835	25,014	10,821	736.9
Theology (B.D., M.Div., or Rabbi)	5,055	4,937	118	7,115	6,133	982	732.2
PERCENT							
Total, all institutions	100	93.5	6.5	100	75.1	24.9	...
Dentistry (D.D.S. or D.M.D.)	100	90.8	9.2	100	76.6	23.4	...
Medicine (M.D.)	100	98.8	1.2	100	86.5	13.5	...
Optometry (O.D.)	100	97.6	2.4	100	84.3	15.7	...
Osteopathic medicine (D.O.)	100	97.7	2.3	100	84.3	15.7	...
Podiatry (Pod.D. or D.P.) or Podiatric medicine (D.P.M.)	100	97.9	2.1	100	87.4	12.6	...
Veterinary medicine (D.V.M.)	100	92.2	7.8	100	67.2	32.8	...
Law (L.L.B. or J.D.)	100	92.7	7.3	100	69.8	30.2	...
Theology (B.D., M.Div., or Rabbi)	100	97.7	2.3	100	86.2	13.8	...

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, p. 18 and Earned Degrees Conferred 1979-80, p. 25.

*Includes degrees which require at least 6 years of college work for completion (including at least 2 years of professional training).

law (9,500), where the number of women increased more than eight-fold between 1971 and 1980. Three out of ten first-professional degrees in law were awarded to a woman in 1980 while less than one out of ten were in 1971.

Degrees in Home Economics

We hypothesize that although market forces cause growing numbers of women to enter nontraditional fields and to make a greater commitment to market work over the lifetime, continued strong demand for the production of nonmarket commodities should cause relatively less decline in home economics than in other traditionally female fields. In fact, the demand for trained specialists with advanced degrees in home economics disciplines may increase as households with two working parents have less time to search for and process all the information that mothers of the fifties--who specialized in home production and supplied few, if any, hours to work outside the home--did. Yet as income rises, the demand for commodities produced in the home continues, and close substitutes for some of these products, such as quantity and quality of children, are not readily available in the market. Thus, the demand for home production continues but the cost of using women's time in the home has risen. This implies shifts (1) in the composition of home production away from time-intensive commodities and toward goods-intensive commodities, such as from a large number of children to a few high-quality children, and (2) away from production techniques intensive of the mother's time toward ones that are relatively more goods-intensive, such as from sole care by mother to use of child-care services. Another response to the increasing value of time can be to improve the efficiency of the time used, i.e., to increase the amount accomplished with each hour of time.

The demand for home-production skills is derived from the household's demand for commodities. Unlike other traditionally female fields, home economics explicitly teaches home production skills. A home economics degree increases efficiency in home production relative to market work more than other fields. For these reasons, we expect relatively less decline in enrollments in home economics than in other traditionally female fields.

In fact, the number of women in home economics continued to grow during the 1970s, by contrast to some of the other traditionally female fields. As seen in Table 6, the number of degrees increased at all degree levels. The number of bachelor's degrees increased by 65 percent, the number of master's by 85 percent and the number of doctorates by 56 percent. Moreover, during this period, the number of men who received degrees in home economics also grew slowly.

At the bachelor's level, the trend within home economics is to become more specialized. Between 1971 and 1980, the lowest percentage increase was in general home economics (14%). The largest percentage growth occurred in the fields of foods and nutrition (219%) and consumer economics and home management (204%), while the largest

Table 6. Bachelor's, Master's, and Doctoral Degrees in Home Economics by Sub-field and Sex in the U.S.: 1970-71 and 1979-80

Field of Study	Bachelor's			Master's			Doctoral		
	1970-71	1979-80	Percent change 1970-71 to 1979-80	1970-71	1979-80	Percent change 1970-71 to 1979-80	1970-71	1979-80	Percent change 1970-71 to 1979-80
HOME ECONOMICS, ALL FIELDS									
Total	11,271	18,583	64.9	1,453	2,690	85.1	123	192	56.1
Percent female	97.3	95.4	...	93.9	91.3	...	6'.0	76.0	...
Home economics, general									
Total	5,483	6,279	14.5	648	871	34.4	18	71	294.4
Percent female	99.1	98.0	...	96.8	97.0	...	100.0	81.7	...
Home decoration and home equipment									
Total	376	820	118.1	31	46	48.4	1	--	--
Percent female	95.5	94.6	...	100.0	89.1	...	100.0	--	--
Clothing and textiles									
Total	1,521	3,254	113.9	123	127	3.3	8	13	62.5
Percent female	99.1	98.1	...	98.4	96.1	...	100.0	92.3	...
Consumer economics and home management									
Total	232	706	204.3	58	91	56.9	5	17	240.0
Percent female	94.4	93.8	...	96.6	97.8	...	80.0	94.1	...

Table 6.--continued

Field of Study	Bachelor's			Master's			Doctoral		
	1970-71	1979-80	Percent change 1970-71 to 1979-80	1970-71	1979-80	Percent change 1970-71 to 1979-80	1970-71	1979-80	Percent change 1970-71 to 1979-80
Family relations and child development									
Total	1,671	3,266	95.5	297	692	133.0	55	56	1.8
Percent female	97.5	95.0	...	84.8	82.4	...	38.2	58.9	...
Foods and Nutrition									
Total	1,017	3,240	218.6	231	756	227.3	33	31	- 6.1
Percent female	98.1	94.1	...	95.7	92.9	...	60.6	80.6	...
Institutional management and cafeteria management									
Total	342	555	62.3	32	57	78.1	2	1	- 50.0
Percent female	62.6	60.7	...	81.3	78.9	...	100.0	100.0	...
Other									
Total	629	463	-26.4	33	50	51.5	1	3	200.0
Percent female	96.7	97.2	...	93.9	84.0	...	100.0	33.3	...

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, p. 15 and Earned Degrees Conferred 1979-80, p. 22.

numerical increases were in foods and nutrition (2,200), clothing and textiles (1,700), and family relations and child development (1,600). At the master's level, the greatest percentage increases occurred in foods and nutrition (227%) and family relations and child development (133%). At the doctoral level, the number of degrees awarded in home economics is very small. The two fields showing significant growth over the period are general home economics (294%) and consumer economics and home management (240%), while a small increase occurred in clothing and textiles (63%).

Of all home economics degrees awarded in 1980, 12.5 percent were at the master's level and 0.9 percent at the doctoral level, whereas the comparable figures for all disciplines were 23.5 percent and 2.4 percent, respectively. Thus, despite the growth in the numbers of master's and doctoral degrees granted in home economics, the field still awards a significantly lower proportion of advanced degrees than other disciplines.

The proportion of degrees awarded to women in home economics decreased between 1971 and 1980 from 97.3 to 95.4 percent at the bachelor's level and from 93.9 to 91.3 at the master's level, but increased from 61.0 to 76.0 percent at the doctoral level. At the bachelor's level, the percentage of men increased in all sub-fields of home economics except the "other" category, while at the master's level, their representation increased in all sub-fields except general home economics, and consumer economics and home management. By contrast, at the doctoral level, the percentage of degrees awarded to women increased in most sub-fields. In 1971, men received home economics doctorates in only three subdivisions, but nine years later they received degrees in every subdivision except institutional management and cafeteria management, in which only one doctorate was awarded.

Sex Segregation in Higher Education and Professional Occupations

As women moved into traditionally male fields of study during the seventies, the extent of segregation of the sexes by field of study should diminish.[1] In this section, we examine the extent of such segregation in higher education for each of the degree levels. Segregation can be measured by an index of segregation based on that developed by Duncan and Duncan (1955) to measure residential segregation. The index of segregation by major field, S^M, is computed as follows:

$$S_t^M = \tfrac{1}{2} \sum_i \left| m_{it} - f_{it} \right| \qquad (1)$$

where m_{it} is the percentage of male students in major field i in year t, and f_{it} is the percentage of female students in major field i in

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[1] Segregation depends upon the sex composition within each field as well as upon the size of various fields. Large sex-segregated fields will increase the degree of segregation more than small ones.

year t. The range of the index is from 0 to 100. A value of 0 indicates that the distribution of women across major fields is identical to that of men, or equivalently that the proportion of women in each major field is equal to the proportion of men. A value of 100 indicates complete segregation, with females enrolled in completely female fields and males in entirely male fields.

Segregation by Field of Study

We computed a time-series of segregation indexes for discipline divisions for bachelor's, master's, doctoral, first-professional degrees and for the last two combined, which appear in Table 7, columns 1-5. It is rather striking that in 1971, the index of segregation is highest at the undergraduate level and declines steadily as we proceed from bachelor's to master's to advanced degrees. By 1980, a reordering occurs in which the bachelor's level becomes less segregated than the master's, while the doctoral and first-professional degree levels continue to be less segregated.[2] The ordering is such that the smaller the proportion of degrees awarded to women, the less segregated the fields and the higher the proportion of degrees awarded to women, the more segregated the fields.

As expected, the index of segregation decreased dramatically between 1971 and 1980 for bachelor's degrees, from 45.99 to 35.21. This figure indicates that 35 percent of women (or men) would have to change majors for the distribution of men and women by field of study to be identical. The rate of decline appears to have accelerated in the period after 1974 and then to have decreased somewhat after 1978. By contrast, the extent of sex segregation at the advanced degree levels remained relatively constant over the period, except for the combined doctoral and first-professional degrees. The index of segregation decreased slowly through 1975 for both the master's and doctoral degrees, and through 1974 for first-professional degrees and then increased slightly thereafter. The combined index decreased steadily from 1972 to 1979 and then increased slightly. Thus, sex segregation by field of study is diminishing at the undergraduate level, and for doctoral and first-professional degrees when taken together.

Segregation in Professional Occupations

The change in women's college majors toward traditionally male fields of study should be associated with their increased entry into traditionally male professional occupations. Since professional occupations generally require at least a college degree, segregation among professional occupations is hypothesized to be positively

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[2]The low segregation index for first-professional degrees taken alo occurs in part because there were no female fields to start with, whereas there were at other levels. Since professional schools compete with doctoral programs for students, it is perhaps more meaningful to treat these degrees as a single unit as in column 5.

Table 7. Sex Segregation Indexes for Earned Degrees and Professional Occupations, 1971-1981

	Earned Degrees					
	Bachelor's	Master's	Doctoral	First-Professional	Doctoral and First-Professional	Professional Occupations
1971	45.99	42.23	31.72	19.82	33.56	...
1972	45.56	42.22	31.37	19.31	35.54	...
1973	44.63	41.49	31.38	15.14	34.30	...
1974	43.17	40.35	30.82	14.56	28.41	56.13
1975	41.31	40.08	30.29	14.70	24.82	56.11
1976	39.59	40.38	30.48	15.69	22.17	55.58
1977	37.71	40.77	31.36	14.70	20.56	54.07
1978	36.45	41.29	31.84	14.10	20.45	53.32
1979	36.07	40.95	31.16	14.73	20.39	51.98
1980	35.21	41.23	32.20	15.60	21.07	50.98
1981	...	...	...	...	...	49.61

Sources: Earned degrees: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 12 and 18; Earned Degrees Conferred 1975-76, pp. 21, 24, 27 and 30; Earned Degrees Conferred 1979-80, pp. 26, 29, 32 and 35; Professional Occupations: U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, 1974 (March), 1975 (June), and 1976 through 1981 (January).

related to segregation among college fields of study. To the extent that a greater similarity arises in the educational preparation of men and women, the degree of sex segregation in professional occupations should decline.

We postulate a relationship in which segregation in professional occupations in year t is a function of segregation by major among bachelor's degree recipients in year t-3, i.e., a three-year lag. While many of last year's college graduates fill this year's job vacancies, several previous years' graduates may also, especially where postgraduate education or training is involved.[3] We thus specify the following equation:

$$S_t^O = a + b\ S_{t-3}^M + e_t \qquad (2)$$

where

S_t^O = the index of segregation among professional occupations in year t;

S_{t-3}^M = the index of segregation among bachelor's degree recipients by major field of study in year t-3;

t = 1974-81.

First, we compute a time-series of segregation indexes for professional occupations for 1974 through 1981, which appear in Table 7, column 6.[4] Combining these data with the time-series of segregation indexes for college majors in column 1, we estimate equation (2). The estimated equation with t-values in parentheses is:

$$S_t^O = \underset{(23.89)}{25.29} + \underset{(26.71)}{0.67}\ S_{t-3}^M \qquad (3)$$

$R^2 = 0.99, \quad N = 8.$

According to these estimates, the relationship between sex segregation among professional occupations and field of study of recent bachelor's

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[3]We postulate a relationship for a single year because the number of years for which we have comparable time-series data is limited. If more years of data were available, a more complex distributed-lag model in which occupational segregation in year t was a function of several previous years of segregation among college graduates might be desirable.

[4]To obtain comparable data over time, aggregate categories of the 3-digit Census professional occupations were used: 24 separate categories were used for 1978-81, 23 for 1975-77, and 18 for 1974.

degree recipients is positive and significant as hypothesized. A 10 percentage point decrease in segregation in college majors is associated with a 6.7 percentage point decrease in segregation in professional occupations three years later. Over this period, the change in women's college majors toward traditionally male fields, i.e., a decline in educational segregation, has been associated with an increase in women's entry into the traditionally male professional occupations, i.e., a decline in occupational segregation. Since these occupations typically require a greater attachment to the labor force than traditionally female occupations, labor force attachment is probably increasing among female college graduates.

Summary

The participation of women in higher education increased and changed substantially during the seventies. Women obtained an increasing proportion of degrees at all degree levels and changed their majors toward fields traditionally associated with men. In 1980, females were awarded nearly half of all bachelor's and master's degrees, slightly less than one-third of all doctoral degrees, and one-fourth of all first-professional degrees. Moreover, at the bachelor's level, substantial increases in women's representation in traditionally male fields of study like business and management, agriculture, engineering, and computer sciences took place. Since these fields tend to lead to employment in occupations that require a relatively continuous attachment to the labor market, the increased educational attainment of women alone probably understates the extent to which the labor force attachment of young women is increasing.

Despite their increased participation in higher education, many degrees are still awarded to women in traditionally female fields of study. The percent is especially high at the master's level. The concentration of women in traditionally female fields in college probably persists in part because of their inadequate preparation at the precollege level. Several studies have shown that women are discouraged from taking advanced coursework in mathematics and sciences at the precollege level and are encouraged to take traditionally female studies (Dearman and Plisko, 1979; Sells, 1973; The Carnegie Commission on Higher Education, 1973). For example, examining data from the National Longitudinal Study of the High School Class of 1972, Dearman and Plisko find that only the few women who were majoring in traditionally male fields in college had taken math and science coursework in high school comparable to that of men. This result is supported by the findings of other researchers as well [Polachek (1978); Peng and Jaffe (1979)]. Polachek found that intended labor force commitment of high school students significantly affects their choice of majors: those with the greatest expectations of lifetime labor force participation tend to major in market-oriented fields, while those with the lowest expectations tend to major in the humanities. If female-dominated fields provide skills that are useful both in the home and in the market, as long as women continue to do most of the work in the home, these fields should continue to be desired majors among women. As is apparent by the continued growth in

home economics enrollments despite the decline among other female fields. The demand for skills useful in home production continues strong. By contrast, the declining enrollments in education, probably due in part to relatively poor salaries for teachers (as well as the decline in the school-age population), will likely continue until something is done about this major social problem. It does not seem that women (or any students) will be able to acquire the needed skills in mathematics and science when few good students train to teach these subjects in high school.

Although our findings show a considerable decline in educational segregation in the colleges during the seventies, room still exists for further change. Improving the preparation of women in high school math and science would enable them to continue to increase their access to nontraditional majors. This, in turn, opens doors to nontraditional occupations, which pay more but also require a more continuous attachment to the labor force than traditionally female occupations.

Appendix

Table A-1. Number and Percentage of Bachelor's Degrees Conferred Upon Women by Major Field of Study in the U.S.: 1970-71 and 1979-80

Major Field of Study	1970-71 Number Awarded to Women	1970-71 As a Percent of Total Awarded	1979-80 Number Awarded to Women	1979-80 As a Percent of Total Awarded	Percent Change 1970-71 to 1979-80
ALL FIELDS	367,687	43.4	462,501	49.2	25.8
Agriculture and natural resources, total	539	4.2	6,787	29.6	1,159.2
Agriculture, general	48	3.2	534	23.3	1,012.5
Animal science	223	9.1	1,658	44.9	643.5
Food science and technology	47	14.1	430	52.2	814.9
Forestry	22	1.2	396	16.7	1,700.0
Horticulture	38	9.8	871	49.7	2,192.1
Natural resources management	28	6.6	643	33.2	2,196.4
Architecture and environmental design, total	667	12.0	2,548	27.8	282.0
Environmental design, general	164	28.9	316	32.0	92.7
Architecture	178	5.1	926	16.9	420.2
City, community, and regional planning	25	10.9	106	26.8	324.0
Interior design	232	73.9	816	90.5	251.7
Landscape architecture	31	6.1	304	30.2	880.6
Area studies	1,322	52.9	1,506	60.5	13.9
Biological sciences, total	10,571	29.3	19,976	42.4	89.0
Biology, general	8,181	30.8	14,806	43.2	81.0
Botany, general	197	36.0	366	50.6	85.8
Bacteriology	143	40.5	141	49.6	-1.4
Biochemistry	138	24.3	596	35.3	331.9
Biophysics	19	35.8	22	21.4	15.8
Ecology	18	18.8	317	36.6	1,661.1
Genetics	24	52.2	38	52.1	58.3
Microbiology	526	46.9	1,209	51.5	129.8
Nutrition (scientific)	24	63.2	85	73.3	254.2
Physiology (human and animal)	32	18.1	136	35.2	325.0
Zoology, general	1,080	19.9	1,303	35.7	20.6

Table A-1.--continued

Major Field of Study	1970-71 Number Awarded to Women	1970-71 As a Percent of Total Awarded	1979-80 Number Awarded to Women	1979-80 As a Percent of Total Awarded	Percent Change 1970-71 to 1979-80
Business and management, total	10,803	9.3	63,883	33.8	491.3
Business and commerce, general	3,084	10.1	11,746	33.5	280.9
Accounting	2,141	9.6	15,760	36.2	636.1
Banking and finance	175	2.9	2,859	25.8	1,533.7
Hotel and restaurant management	48	7.8	517	30.2	977.1
Marketing and purchasing	1,289	8.1	8,486	38.2	558.3
Real estate	16	3.8	130	15.0	712.5
Insurance	14	2.9	124	22.1	785.7
Secretarial studies	1,361	97.6	1,890	96.5	38.9
Transportation and public utilities	6	.9	255	19.3	4,150.0
Business management and administration	1,991	7.0	19,044	30.8	856.5
Personnel management	89	7.4	893	40.0	903.4
Labor and industrial relations	54	4.7	552	39.5	922.2
Operations research	7	5.1	117	21.9	1,571.4
Communications	3,813	35.3	14,983	52.3	292.9
Communication, general	666	38.4	6,330	54.6	850.5
Journalism	2,261	44.0	4,818	56.7	113.1
Radio-television	338	17.8	1,703	38.0	403.8
Advertising	312	26.1	1,163	59.9	272.8
Communication media	148	31.0	760	45.0	413.5
Computer and information sciences, total	324	13.6	3,399	30.3	949.1
Computer and information sciences, general	236	14.5	2,738	29.8	1,060.2
Information sciences and systems	31	17.5	395	32.6	1,174.2
Data processing	49	12.0	182	31.4	271.4
Education, total	132,236	74.4	89,214	73.9	-32.5
Elementary education, general	82,722	90.9	38,799	89.6	-53.1
Secondary education, general	2,141	57.6	2,011	58.9	- 6.1
Junior high school education	461	63.9	264	78.1	-42.7
Special education, general	1,979	85.3	8,171	90.5	312.9
Education of the mentally retarded	2,265	85.8	1,858	89.9	-18.0

Table A-1.--continued

Major Field of Study	1970-71 Number Awarded to Women	1970-71 As a Percent of Total Awarded	1979-80 Number Awarded to Women	1979-80 As a Percent of Total Awarded	Percent Change 1970-71 to 1979-80
Speech correction	2,074	88.0	1,332	95.2	-35.8
Pre-elementary education	3,358	98.6	4,782	97.0	42.4
Art education	4,084	71.8	2,026	77.1	-50.4
Music education	4,212	57.8	3,628	57.9	-13.9
Physical education	9,565	38.6	10,114	49.4	5.7
Health education	642	59.0	1,731	72.8	169.6
Home economics education	6,415	98.5	2,107	99.5	-67.2
Engineering, total	403	.8	6,438	9.3	1,497.5
Engineering, general	35	1.2	478	12.0	1,265.7
Chemical engineering	63	1.8	1,215	19.0	1,828.6
Civil, construction, and transportation engineering	54	.8	991	9.5	1,735.2
Electrical, electronics, communications engineering	76	.6	902	6.5	1,086.8
Mechanical engineering	41	.5	882	7.4	2,051.2
Fine and applied arts, total	18,169	59.7	25,865	63.2	42.4
Fine arts, general	2,343	64.6	2,864	66.3	22.2
Art	6,770	63.3	9,040	68.2	33.5
Art history and appreciation	1,376	80.5	1,617	82.2	17.5
Music performing, composition, theory	1,759	53.0	2,828	52.3	60.8
Music liberal arts program	1,528	57.6	1,847	55.2	20.9
Dramatic arts	2,019	54.8	3,078	59.2	52.5
Applied design	1,132	55.3	2,851	68.4	151.9
Foreign languages	15,285	74.8	8,568	75.7	-43.9
Health professions, total	19,680	77.2	53,151	82.3	170.1
Nursing	12,029	97.9	31,054	94.5	158.2
Public health	36	28.3	347	59.2	863.9
Pharmacy	951	20.7	2,919	41.0	206.9
Physical therapy	1,045	80.0	1,845	77.8	76.6
Occupational therapy	662	96.1	1,617	95.5	144.3
Speech pathology and audiology	1,251	87.7	3,319	92.8	165.3
Medical laboratory technologies	2,755	87.6	4,128	80.5	49.8

Table A-1.--continued

Major Field of Study	1970-71 Number Awarded to Women	1970-71 As a Percent of Total Awarded	1979-80 Number Awarded to Women	1979-80 As a Percent of Total Awarded	Percent Change 1970-71 to 1979-80
Home economics, total	10,970	97.3	17,722	95.4	61.5
Home economics, general	5,434	99.1	6,153	98.0	13.2
Home decoration and home equipment	359	95.5	776	94.6	116.2
Clothing and textiles	1,508	99.1	3,191	98.1	111.6
Consumer economics and home management	219	94.4	662	93.8	202.3
Family relations and child development	1,630	97.5	3,104	95.0	90.4
Foods and nutrition	998	98.1	3,049	94.1	205.5
Institutional management and cafeteria management	214	62.6	337	60.7	57.5
Other	608	96.7	450	97.2	-26.0
Law	27	5.0	311	45.5	1,051.9
Letters	44,782	61.9	24,328	59.4	-45.7
English, general	34,628	67.0	15,852	67.0	-54.2
Literature, English	2,952	64.9	1,282	60.7	-56.6
Philosophy	1,166	20.1	1,050	28.3	- 9.9
Religious studies	855	36.2	1,219	36.1	42.6
Library science	932	92.0	378	95.0	-59.4
Mathematics	9,494	38.1	4,848	42.3	-48.9
Physical sciences, total	3,014	14.0	5,651	23.9	87.5
Physical sciences, general	148	14.9	222	21.3	50.0
Physics	339	6.7	398	12.1	17.4
Chemistry	2,089	18.7	3,274	28.6	56.7
Geology	262	11.1	1,105	24.9	321.8
Psychology, total	17,037	44.7	26,923	63.3	58.0
Psychology, general	16,723	44.6	25,803	63.4	54.3
Social psychology	45	57.7	228	59.8	406.7
Public affairs and services, total	4,566	49.1	21,093	55.3	362.0
Community services, general	156	67.0	1,235	74.8	691.7
Parks and recreation management	563	34.7	3,352	58.3	495.4
Social work and helping services	3,538	75.4	10,503	81.6	196.9
Law enforcement and corrections	189	9.2	5,021	33.4	2,556.6

Table A-1.--continued

Major Field of Study	1970-71 Number Awarded to Women	1970-71 As a Percent of Total Awarded	1979-80 Number Awarded to Women	1979-80 As a Percent of Total Awarded	Percent Change 1970-71 to 1979-80
Social sciences, total	57,918	37.0	45,805	43.7	-20.9
Social sciences, general	9,982	45.6	4,402	50.2	-55.9
Anthropology	2,433	55.5	2,258	62.6	- 7.2
Economics	1,912	12.0	5,430	30.2	184.0
History	15,749	35.1	7,293	37.6	-53.7
Geography	869	20.9	1,108	32.0	27.5
Political science and government	5,564	20.1	9,212	35.9	65.6
Sociology	19,959	59.3	12,781	66.7	-36.0

Sources: National Center for Education Statistics, Earned Degrees Conferred 1970-71, pp. 13-17 and Earned Degrees Conferred 1979-80, pp. 20-24.

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